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# (54) FOOD CONTAINER

(71) We, ENERGY CONVERSION SYSTEMS, INC., a Corporation organized and existing under the laws of the State of New Mexico, United States of America, of 623 Wyoming, S.E., Albuquerque, New Mexico, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an improved food container and in particular to a food container incorporating the heat pipe heat exchange principle into the structure thereof so that the food contained therein can be alternatively cooked rapidly and evenly or rapidly cooled by reason of the increased heat transfer capacity of the container.

In the food container art, there has been a long standing unsolved need for a container which is suitable for both cooking food and for cooling the food, particularly where the food is to be frozen after it is cooked. The present invention solves this need by structurally incorporating the heat pipe concept into the food container.

The high heat transport rate and near isothermal characteristics of heat pipes are well known in the art. United States Patent No. 3,299,759 discloses the concept of the use of heat pipes for efficient transfer of heat from one point to another.

In the cooking utensil art, which is one aspect of this combination device, there are a great number of devices designed for achieving optimum transfer of heat between the heat source and the item being cooked as well as uniform application of heat to the item being cooked. One of the most common practices of prior art devices is that of bonding a material of high heat conductivity such as copper or aluminum to the bottom and sides of the cooking utensile. Such a procedure does in fact increase heat transfer, but it often results in hot spots in the utensil and over-heating the outside of the item being cooked while the interior is not cooked at all. Moreover, such utensils are not suitable or designed for cooling the food but are limited to the cooking function. In addition, while these prior art devices do improve the heat transfer from the heat source to the food to some extent, they have not been altogether successful since their heat transfer efficiency is limited.

If the heat pipe principle is applied to food containers, the result is increased heat transfer efficiency between the food and the container. One problem with bulky food items, however, is that the increased efficiency of heat transfer of such a device will also result in the food being cooked more rapidly on the outside while the inside cooks at the same rate as with prior art utensils. Therefore, the outside of such food will burn before the inside is cooked. As a matter of fact, the increased heat transfer efficiency will have the same effect as if the heat source were increased in intensity thus burning the outside of the food before it is cooked on the inside.

In order to structurally incorporate the heat pipe principal into a food container for increasing the efficiency of cooking or cooling food and avoid the problem of overheating the outside of the food as it is being cooked, it is necessary that a combination mechanism be devised so that the inside of the food is cooked at an increased rate in proportion to the increased rate in which the outside is cooked.

According to the invention there is provided a food container comprising a bottom surrounded by sides and an open top, said bottom and sides being constructed of heat conducting material and having interior and exterior walls spaced apart and defining a sealed hollow space therebetween and a fluid saturated wick positioned within said sealed hollow space and adjacent the interior walls defining said sealed hollow space so as to form a vapor passage between said wick and the interior of said

sealed hollow space; whereby heat is transferred through the bottom and sides of said container by evaporation and condensation of the fluid in said fluid saturated wick.

A lid constructed in the form of a heat pipe may be provided for the container, and a heat pipe type insert may be provided for insertion into bulky food items to conduct heat into the interior thereof.

The invention will be better understood by reference to the following description, given by way of illustration only, with reference to the accompanying drawings, wherein:

Figure 1 is a cross-sectional view of an improved food container according to the invention;

Figure 2 is a cross-sectional view of a heat transfer insert in combination with a bulky food item; and

Figure 3 is a cross-sectional view of the heat transfer insert.

Referring now to the drawings wherein like numerals represent like parts, it will be seen that the improved food container 9 consists of three separate parts, including a bottom 10, a lid 11 and a heat transfer insert 12. The food contained in the device is designated as 13.

Bottom 10 is formed of an exterior wall 14 and interior wall 15 which are joined together around the upper edges of bottom 10 and are otherwise spaced apart to define an annular space therebetween. A fluid transfer wick 16 lines the interior of the annular space between walls 14 and 15. It is saturated with a working fluid such as distilled water. The annular or hollow space forms a vapor passage 17.

In a cooking operation the heat would be conducted from the heat source outside bottom 10 to the food 13, and in the cooling operation heat would be conducted from the food 13 to the relatively cooler environment in which food container 9 is placed. Upon reaching the working fluid, the heat causes it to evaporate out of wick 16 and enter vapor passage 17 where it is disbursed throughout the vapor passage 17. Upon contacting the cooler surface of one of the walls of bottom 10 or lid 11, the vapor gives up its latent heat of vaporization which heat will, in turn, be conducted either into the food 13 in the cooking application or to the environment if it is cooler than food 13. The condensed vapor is absorbed into wick 16 where it is returned by capillary action to the heat source. The working fluid in wick 16 may be a harmless liquid such as distilled water so that the food will not be contaminated in case of a leak in the walls of any part of the container 9.

Lid 11 of container 9 is also made in the form of a heat pipe. Thus lid 11 is formed of heat conducting material with a hollow or annular space defined in its interior. A fluid transfer wick 16 saturated with working fluid lines the interior walls of the annular space forming a vapor passage 17 surrounded by wick 16.

Heat transfer insert 12 comprises the third element of the combination improved food container 10 for use with bulky food items such as that shown at 13. Insert 12 is also constructed in the form of a heat pipe and as shown is cylindrical in shape with a point 26 at one end for easy insertion into food 13. Heat transfer insert 12 comprises a heat receiver 21 connected in thermal conducting relationship to probe 22 which is constructed in the form of a heat pipe. Probe 22 may be constructed in the form of a hollow cylindrical member or in any other suitable shape having a fluid transfer wick 24 lining its interior surface and forming a vapor passage 25 defined in the space between wick 24 and the innermost portion of probe 22. In normal use, insert 22 is inserted into a bulky food item with heat receiver 21 being exposed to the heat source. This source could be either the interior of an oven, or the interior of food container 10 or another similar heat source, if the food is being cooked. If the device is being used to cool food, then, of course, heat receiver 10 would become a heat sink and would be exposed to a source of less temperature than the interior of the food, such as a refrigerator or freezer. The angle of incline of probe 22 in bulky food item 13 is not important, as it is in some prior art devices since the device does not depend on gravity for its operation.

In the cooking operation, heat is received into heat receiver 21 which conducts the heat into probe 22 and thence into the fluid stored in wick 24. The evaporization-condensation heat transfer process begins by evaporation of the working fluid with the vapor being conducted through vapor passage 25 into that portion of probe 22 in the cooler interior of bulky food item 13. There the vapor is condensed giving up its latent heat of vaporization and the resulting fluid is absorbed into wick 24 where it is returned by capillary action to the heat receiving end of hollow member 23. In the event heat transfer device 12 is being used as a food cooler, the evaporation-condensation process would simply be reversed so that heat is conducted from the interior of food item 13 to heat receiver 21 where it is rejected into the environment.

Food container 9 is useful for many different applications. For example, the device could be used with only bottom 10 and without either lid 11 or heat transfer insert 12 in applications where it is not necessary to transfer heat into the interior of the food, or where heat is only applied to the bottom of container 9, such as in frying food. In that particular application, it would not be desirable to use lid 11 since it would serve as a heat rejector and thus work against the cooking heat applied to the food.

Another application of heat insert 12 lies

in the field of temperature measuring. In such applications, heat receiver 21 on heat transfer insert 12 would be removed from the device and a thermometer substituted therefor. The heat at the interior of the food 14 would be transferred to its exterior and registered on the thermometer.

This particular food container can without additional invention be combined with any source of heat such as an electrical coil bonded to bottom 10, a gas or electric stove or some other similar heat source.

One important application of this device is in camp cooking utensils where it is often quite difficult to get uniform heat distribution throughout the entire surface of the cooking utensil. It is well known that a camp fire or a camp cook stove usually applies heat to an isolated spot on the cooking utensil thus resulting in burning of the items being cooked. The device comprising the present invention eliminates this danger since it causes the heat to be distributed evenly throughout the utensil to provide uniform heat distribution.

WHAT WE CLAIM IS:—

1. A food container comprising a bottom surrounded by sides and an open top, said bottom and sides being constructed of heat conducting material and having interior and exterior walls spaced apart and defining a sealed hollow space therebetween, and a fluid saturated wick positioned within said sealed hollow space and adjacent the interior walls defining said sealed hollow space so as to form a vapor passage between said wick and the interior of said sealed hollow space, whereby heat is transferred through the bottom and sides of said container by evaporation and condensation of the fluid in said fluid saturated wick.

2. A container according to claim 1 which includes a lid adapted to cover the open top of the container, said lid being constructed of heat conducting material and having a sealed hollow interior, a fluid saturated wick lining the interior walls of said sealed hollow interior and a vapor passage defined between said fluid saturated wick and the innermost portion of said sealed hollow interior so that when the heat is applied to the fluid in the said wick, it is evaporated and conducted through the vapor passage in said sealed hollow interior into the cooler portions thereof where the vapor is condensed giving up its latent heat of vaporization.

3. A container according to claim 2 which includes a heat transfer insert having a first and a second end, said heat insert being constructed of a heat conducting material and having a sealed, hollow interior lined with a fluid saturated wick, a vapor passage defined by the fluid saturated wick and the innermost portion of said sealed hollow interior, a heat receiver attached to the first end of said heat transfer insert in a heat conducting relationship and being constructed of a heat conducting material so that heat received by said heat receiver is conducted to the first end of the said heat transfer insert if the heat receiver is at a higher temperature than the first end of the heat transfer insert and heat is conducted frofff the first end of said heat transfer insert into said heat receiver if it is at a lower temperature than the second end of said heat transfer insert, said second end of said heat transfer insert being pointed so that it can be readily inserted into a bulky food item to thereby conduct heat from the exterior of the food item to its interior if the interior is cooler than the exterior, or remove heat from the interior of the food item if the interior is warmer than the exterior.

4. A container according to claim 2, which includes a heat transfer insert having a first and a second end, said heat insert being constructed of a heat conducting material and having a sealed, hollow interior lined with a fluid saturated wick, a vapor passage defined by the fluid saturated wick and the innermost portion of said sealed hollow interior and a temperature measuring device attached to the first end of said heat transfer insert in a heat conducting relationship to measure the temperature thereof.

5. A food container substantially as hereinbefore described and as illustrated in the accompanying drawings.

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1275846 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

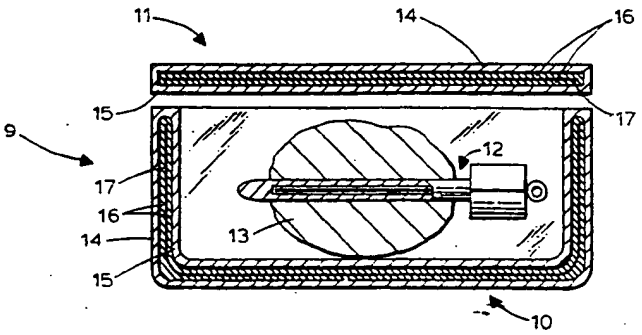


FIG 1

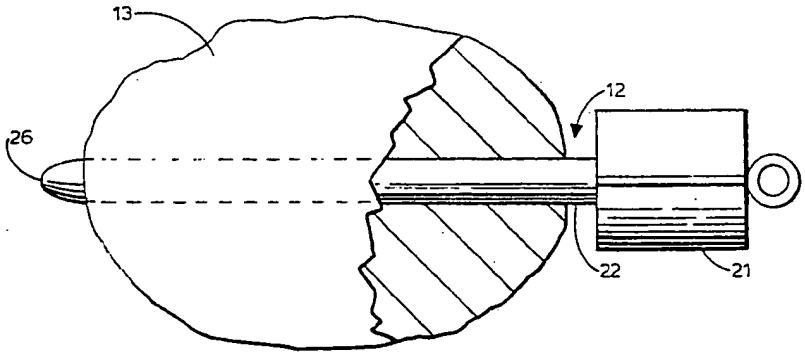


FIG 2

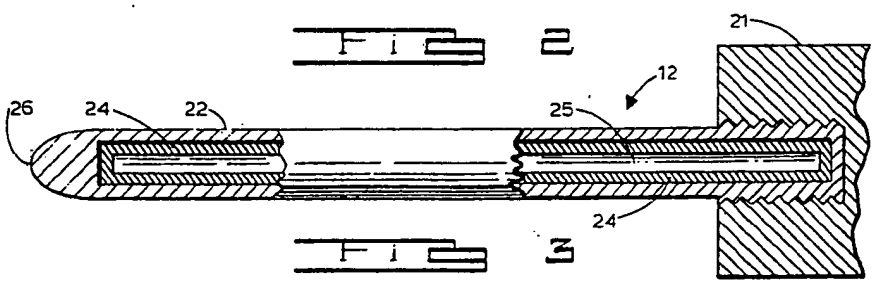


FIG 3